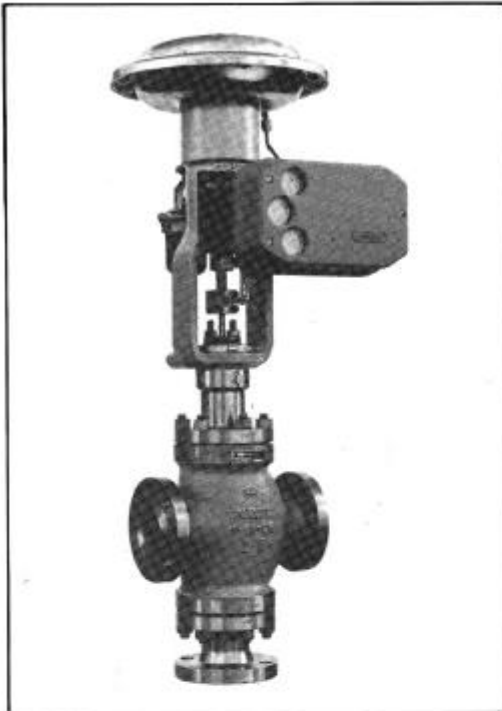




**3-WAY CONTROL  
VALVES**

## 3-WAY CONTROL VALVES



### 1-6113 Series 3-WAY MIXING TYPE

1-6113 series valves are foreseen to reunite two flows, e.g. in blending processes. These valves have two inlets and one outlet and must be installed in such a way that the flow opens both plug passages. So vibrations and slamming can be avoided and steady control can be achieved.

#### BODY

Sizes : 1" minimum ÷ 12" maximum  
Connections : Flanged  
Ratings : Flanged connections PN 10-16-25-40  
ANSI 125-150-250-300.  
Ratings up to PN 100 - ANSI 600 upon request  
Materials : Carbon, stainless or CrMo steel  
Other materials on request

#### BONNET

Construction : Plain or extended  
Finned on request  
Materials : Carbon or stainless steel  
Packing : Teflon-graphite, pure graphite

#### INTERNAL ASSEMBLY

Plug : Linear V-port  
On-Off disc type  
Optional reduced ports  
Materials: stainless steel AISI 316  
Stellite coating - Hastelloy etc.  
Teflon inserts  
Guiding: top and in the seat  
Seat : Stainless steel AISI 316  
Stem : Rolled stainless steel AISI 316  
Guiding : Stainless steel AISI 420 for Carbon and CrMo steel bodies

#### DIAPHRAGM ACTUATORS

Connections : 1/4" female NPT  
Spring ranges : 3 ÷ 15, 6 ÷ 30, 12 ÷ 23 psi  
Action : Air-to-close angle way (direct actuator)  
Air-to-open angle way (reverse actuator)

### 1-8113 Series 3-WAY DIVERTING TYPE

1-8113 series valves are foreseen to divert a single flow into two flows of variable proportions. The single inlet and the two outlet connections must be made in such a way that the flow will tend to open both passages.

#### BODY

Sizes : 1½" minimum ÷ 12" maximum  
Connections : Flanged  
Rating : Flanged connections PN 10-16-25-40  
ANSI 125-150-250-300.  
Ratings up to PN 100 - ANSI 600 upon request  
Materials : Carbon, stainless or CrMo steel  
Other materials on request

#### BONNET

Construction : Plain or extended  
Finned on request  
Materials : Carbon or stainless steel  
Packing : Teflon-graphite, pure graphite

#### INTERNAL ASSEMBLY

Plug : Linear V-port type  
On-off disc type  
Optional reduced ports  
Materials: stainless steel AISI 316  
Stellite coating - Hastelloy etc.  
Teflon inserts  
Guiding: top and in the seat  
Seat : Stainless steel AISI 316  
Stem : Rolled stainless steel AISI 316

Guiding : Stainless steel AISI 420 for Carbon and CrMo steel bodies

**DIAPHRAGM ACTUATORS**

Connections : 1/4" female NPT

Spring ranges : 3 ÷ 15, 6 ÷ 30, 12 ÷ 23 psi

Action

ACTION ON STRAIGHT WAY		
Valve series	1-6113	1-8113
DIRECT Actuator	TO OPEN	TO CLOSE
REVERSE Actuator	TO CLOSE	TO OPEN

VALVE SIZE - in.	1 (1)		1 1/2	2	3	4	6	8	10
Nominal Trim Size - in.	1	1/2	1 1/2	2	3	4	6	8	10
Throttling Plug CV (2)	12	8	32	47	105	165	352	615	935
On-Off Plug CV (3)	16,5	12,5	40	53	120	185	390	660	1015
Seat Ring Diameter - mm	28	23	45	50	72	90	130	165	210
Stroke - mm	17	17	25	25	34	45	60	60	76

NOTES: (1) 1-6113 only; (2) Straight-way CV. Angle way has 10% higher values; (3) Same values for straight and angle way

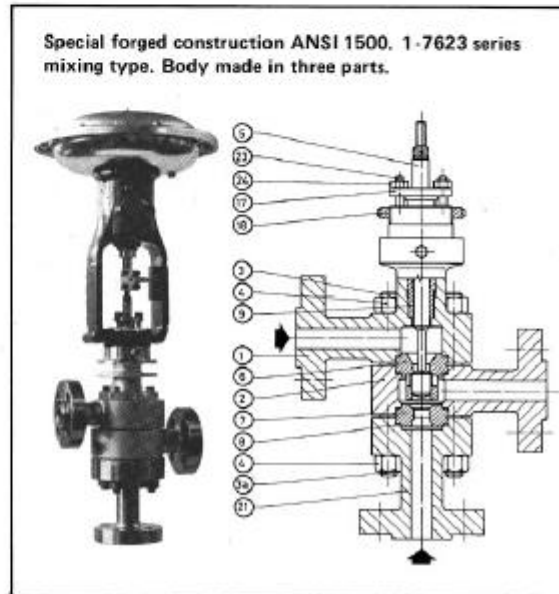
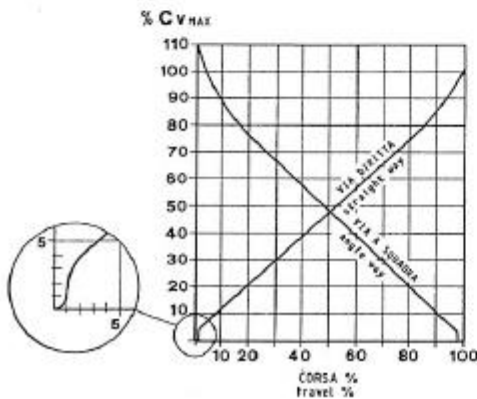
**F<sub>L</sub> and x<sub>T</sub> coefficients for V-PORT throttling plug**

DN in.	port. in.	100% of rated Cv				10% of rated Cv	
		STRAIGHT WAY		ANGLE WAY		F <sub>L</sub>	x <sub>T</sub>
		F <sub>L</sub>	x <sub>T</sub>	F <sub>L</sub>	x <sub>T</sub>		
1	3/4	0.91	0.65	0.87	0.57	0.95	0.86
1	1	0.92	0.67	0.88	0.59	0.95	0.86
1 1/2	1 1/2	0.91	0.65	0.87	0.57	0.95	0.86
2	2	0.92	0.67	0.88	0.59	0.95	0.86
3	3	0.92	0.67	0.88	0.59	0.93	0.82
4	4	0.93	0.68	0.89	0.60	0.93	0.82
6	6	0.93	0.68	0.89	0.60	0.93	0.82
8	8	0.93	0.68	0.89	0.60	0.93	0.82
10	10	0.93	0.68	0.89	0.60	0.93	0.82

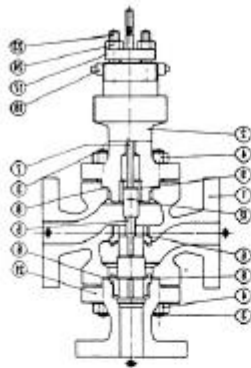
**F<sub>L</sub> and x<sub>T</sub> coefficients for disk type plug**

STRAIGHT WAY		ANGLE WAY	
F <sub>L</sub>	x <sub>T</sub>	F <sub>L</sub>	x <sub>T</sub>
0.90	0.64	0.85	0.55

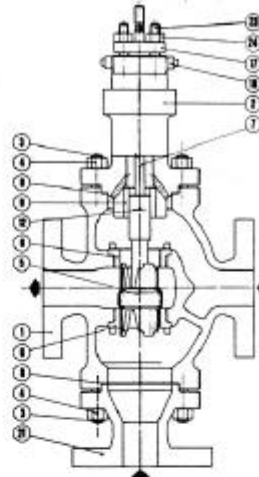
**Linear characteristic curves 1-6113 and 1-8113**



## PARTS REFERENCE

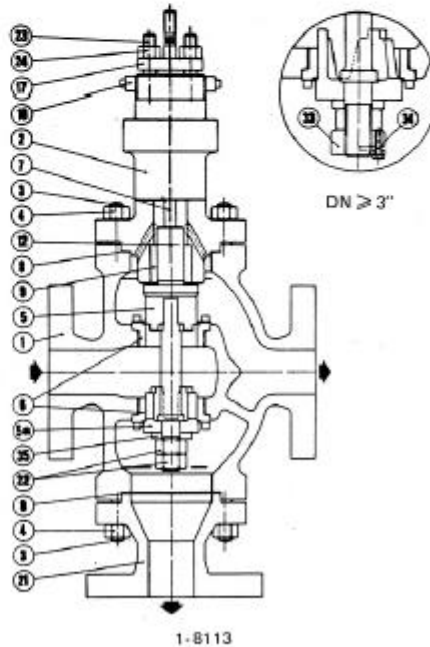


1-6113 DN 1"



1-6113 DN ≥ 1 1/2"

35	Washer
34	Screw
33	Elastic nut
24	Nut
23	Stud bolt
22	Nut
21	Bottom flange
18	Clamping nut
17	Packing flange
12	Pin
9	Guide bushing
8	Gasket
7	Stem
6	Seat ring (**)
5-5a	Valve plug
4	Nut
3	Stud
2a	Finned or extended bonnet (*)
2	Standard bonnet
1	Body



1-8113

(\*) Not shown

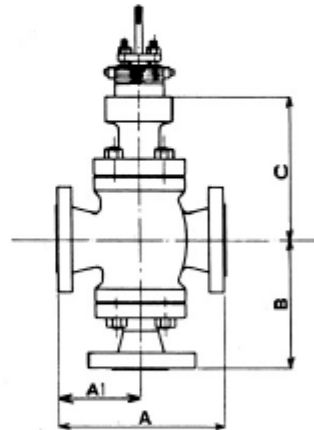
(\*\*) The two seats are identical, both in 1-6113 and 1-8113 valves.

Part-list references can be used when ordering spare parts. Always specify the series of valve (1-6113 or 1-8113).

**OVERALL DIMENSIONS - mm (1) (4)**

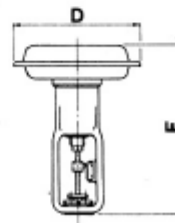
DN	A (2)						A <sub>1</sub>						B (2)						C		
	ANSI 150		ANSI 300		ANSI 600		ANSI 150		ANSI 300		ANSI 600		ANSI 150		ANSI 300		ANSI 600		Std.	Ext.	
mm	in.	RF	RJ	RF	RJ	RF	RJ	RF	RJ	RF	RJ	RF	RJ	RF	RJ	RF	RJ	RF	RJ		
25 (3)	1 (3)	184	197	197	210	210	210	92	98,5	98,5	105	105	105	140	146,5	140	146,5	146,5	146,5	155	230
40	1 1/2	222	235	235	248	251	251	102	108,5	108	114,5	116	116	201	207,5	201	207,5	229	229	225	325
50	2	254	267	267	283	286	289	120	126,5	126	134	135	136,5	217	223,5	217	225	245	247	232	332
80	3	298	311	317	333	337	340	129	135,5	139	147	149	151	267	273,5	267	275	298	300	290	400
100	4	352	365	368	384	394	397	148	154,5	156	164	170	171,5	307	313,5	307	315	346	348	335	455
150	6	451	464	473	489	508	511	192	198,5	203	211	221	222,5	407	413,5	407	415	459	461	402	542
200	8	543	556	568	584	610	613	230	236,5	241	249	261	263	459	465,5	459	467	500	502	443	603
250	10	673	686	708	724	752	755	283	289,5	300	308	323	324,5	550	556,5	550	558	600	602	532	712
300	12	737	750	775	791	819	822	310	316,5	328	336	352	353,5	670	676,5	670	678	720	722	650	830

- (1) Both 1-6113 and 1-8113 dimensions.
- (2) Tolerance on "A-B" values: ± 1,5 mm for sizes up to 10"; ± 3 mm for size 12" and above; "A<sub>1</sub>" = ± 1.
- (3) 1-6113 only.
- (4) Dimensions for ANSI 125, PN 10, PN 16 are the same as for ANSI 150.  
Dimensions for ANSI 250, PN 25, PN 40, are the same as for ANSI 300.



**Diaphragm Actuators**

Type	D	E		Mass - kg	
		Direct action	Reverse action	Dir.	Rev.
250	266	398	461	15	16
310	325	412	494	16	19
390	400	511	662	29	39
450	482	584	750	48	63
600	631	754	954	98	130
600L	631	940	1132	140	175



## HEAT EXCHANGE CONTROL

The most important application of 3-way control valves series 1-6113 and 1-8113 is heat exchange control. The summary set out below is an extract from a paper that Parcol presented at the "Diathermic Fluids" Conference held on 18/5/1972. The paper was concerned with diathermic fluid exchanges.

### GENERAL

The main problem of the control in a diathermic fluid line is the control of the temperature of a product which is heated by the fluid in a heat exchanger.

Figures 1-2 and 3 illustrate three of the most common types of installation.

Figure 1. 3-way valve from the inlet of the by-pass (diverting valve)

Figure 2. 3-way valve from the outlet of the by-pass (mixing valve)

Figure 3. Two 2-way valves.

The use of the by-pass is advisable to obtain a constant pressure in the main circuit so as to avoid "cracking" phenomena in the boiler due to overheating.

The three types of installation control the temperature by increasing or decreasing the flow of the heating fluid in the by-pass.

In figure 1, the TC located at the fluid outlet controls the 3-way diverting valve located at the inlet of the by-pass.

The heating fluid tends to open the two plug so that its flowing is free from vibrations.

When the temperature increases the air pressure decreases (inverse control) and opens the by-pass. When there is no air the by-pass remains open and there is no danger of overheating in the exchanger.

In figure 2, the TC controls the mixing valve at the outlet of the by-pass.

In this installation too the fluid tends to open the two plugs.

When the temperature increases the controller (reverse action) opens the by-pass.

When there is no air the by-pass remains open.

In Figure 3, the two valves are usually installed so that if there is no air the valve that is in series with the exchanger closes and the by-pass valve opens. The valves are complementary to each other. When one is open the other is closed.

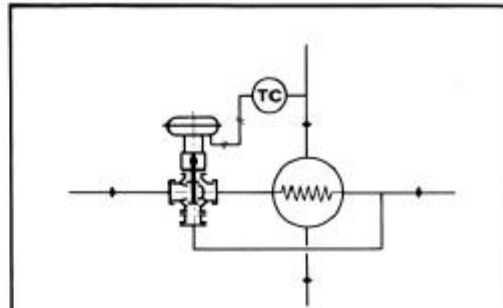


Fig. 1 - Temperature control with a 3-way valve from the inlet of the by-pass (diverting valve)

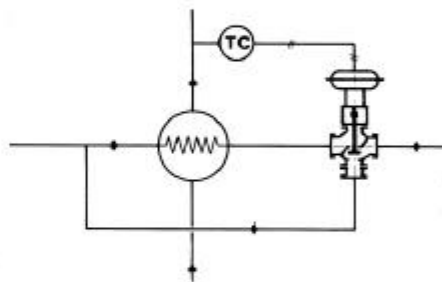


Fig. 2 - Temperature control with a 3-way valve from the outlet of the by-pass (mixing valve)

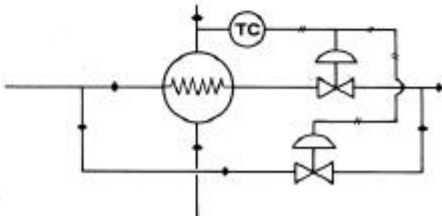


Fig. 3 - Temperature control with two 2-way valves

## SELECTION OF THE CONTROL SYSTEM

The best control system must be determined by the temperature of the fluids, the cost of the installation and the reliability requirements.

### Fluid temperature:

The first choice of system can be based on a knowledge of the difference in temperature between the inlet and outlet of the exchanger. It should be noted that 3-way valves (which are the subject of this paper) are particularly susceptible to thermic distortion. In fact:

1) the body is connected to the piping at three points and is thus less able to withstand stresses on its flanges caused by thermic expansion.

The maximum temperature that 3-way valve can withstand is 425°C. Above this limit it is advisable to use two 2-way valves (Fig. 3.)

2) The body is split type and is therefore liable to misalignment.

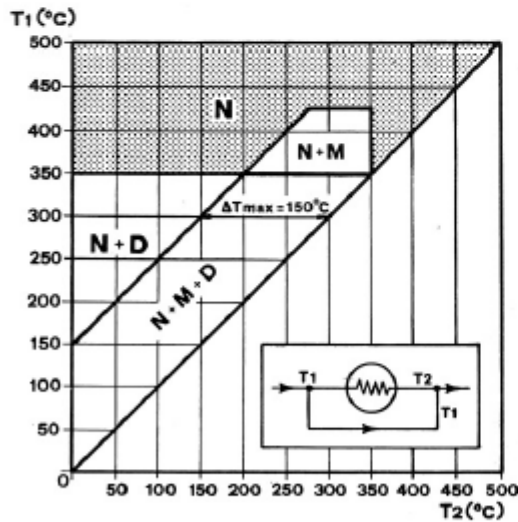


Fig. 4 - Application range for three-way valves

Type: D 3-way diverting  
M 3-way mixing - NPS  $\geq 1\frac{1}{2}$ "  
N 2-way

For 1-6113 series control valve (type M) NPS 1" the  $\Delta T_{max}$  is = 80°C.

Figure 4. shows a summary of the application ranges of the different valves. It can be seen that for inlet temperatures up to 350°C, diverting valves are more frequently used than mixing valves even though the latter, which are installed at the outlet, have an average lower body temperature and therefore accept an higher  $T_1$ .

### Installation cost

The approximate cost relationship of the different installations is set out in the following table in which it has been assumed that the cost of the 3-way diverting valves is equal to 100 (3" valves have been used as a reference).

Installation type	Figure No.	Cost	
		Without Positioner	With Positioner
3-way diverting	1	100	100
3-way mixing	2	85	90
Two 2-way valves	3	140	160

The most economic solution is the 3-way mixing valve followed by the 3-way diverting valve and lastly the two 2-way valves.

For this reason the two 2-way valves are normally used only when the temperature limits exclude the use of the 3-way valves.

### Reliability of the system

Apart from temperature considerations which limit the use of the various types of valves, 3-way valves eliminate completely the danger of a control setting-off which could be possible in a two 2-way valve system if one valve is blocked or damaged.

This is because the two plug lock screws are mechanically connected.

